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1988–1990

ANNUAL SURVEY REPORT

U.S. Pharmaceutical Industry

Pharmaceutical Manufacturers Association

ANNUAL SURVEY REPORT

PMA 1988-1990

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Foreword

The Pharmaceutical Manufacturers Association (PMA) is a non-profit trade association of over 100 research-based pharmaceutical companies. These firms produce most of the ethical pharmaceuticals sold in the United States and a substantial portion of the world supply.

The Annual Survey is designed to provide information on the ethical pharmaceutical industry to business executives, financial analysts, educators, and other interested groups.

Survey questions are updated periodically and the scope of the survey expanded or reduced to reflect changing priorities. However, an effort is made to maintain continuity and comparisons with earlier surveys can be made in most categories.

Responses to surveys are reasonably uniform and consistent, but there are minor variations, from year to year. To compensate for these, adjustments are made based on supplementary data available to PMA from other sources. No adjustment has been made for inflation; data are presented in current dollars for manufacturers' sales and R&D expenditures.

Although this is a membership survey, selected operational totals include estimates for nonmember firms based on data obtained from other sources. For example, aggregate human-dosage form drug sales have been extrapolated to represent the entire industry. However, extrapolation was not possible for bulk sales, veterinary use pharmaceuticals, foreign data or R&D. In order to maintain continuity of the data, some firms who are no longer PMA member firms are represented by estimate in the data for PMA members.

TRENDS

1988–1990[a] Pharmaceutical Industry Operations PMA Member Firms

Global sales in 1989 were estimated to exceed $51 billion, nearly three times higher than sales ten years ago. Global R&D expenditures exceeded $7 billion for the first time and have more than quadrupled since 1979. The trends for 1988-1990 are shown below.

- Global Sales, Ethical Pharmaceuticals, Human and Veterinary Use:
  1988 $46.9 billion, up 12.7% from 1987
  1989 $51.2 billion, up 9.2% from 1988
  1990 $57.4 billion, up 12.1% from 1989

- U.S. Sales[b], Human-Use, Dosage-Form Pharmaceuticals:
  1988 $31.2 billion, up 10.2% from 1987
  1989 $34.6 billion, up 10.9% from 1988
  1990 $38.6 billion, up 11.6% from 1989

- Global R&D Expenditures for Human and Veterinary Use Pharmaceuticals:
  1988 $6.5 billion, up 18.2% from 1987
  1989 $7.3 billion, up 12.3% from 1988
  1990 $8.2 billion, up 12.3% from 1989

Table 1

[a]Figures for 1989–90 are budgeted or estimated figures.
[b]U.S. sales figures apply to all U.S. firms, not PMA member firms only.

U.S. Pharmaceutical Industry Sales & R&D Expenditures, 1964-1990[a] (millions of dollars)

1

Year	U.S. Sales[b]	Global Sales and R&D-PMA Member Firms		
		Sales Human and Veterinary[c]		R&D[d]
	Human Dosage	*Dosage Only*	*Dosage & Bulk*	*Human & Veterinary*
1990[e]	38,595	55,305	57,407	8,229
1989[e]	34,552	49,376	51,252	7,346
1988	31,224	45,088	46,973	6,537
1987	28,288	40,111	41,635	5,505
1986	25,227	35,685	37,137	4,740
1985	22,065	30,698	32,026	4,078
1984	19,345	28,615	29,854	3,579
1983	17,278	26,254	27,506	3,218
1982	15,394	24,466	25,654	2,774
1981	13,000	22,378	23,530	2,340
1980	11,799	21,460	22,513	1,977[f]
1979	10,044	17,789	18,939	1,627
1978	9,156	15,463	16,431	1,404
1977	8,233	13,377	14,155	1,276
1976	7,669	12,295	13,035	1,164
1975	6,895	11,129	11,769	1,062
1974	6,083	9,755	10,361	942
1973	5,507	8,403	8,839	825
1972	5,018	7,576	7,930	726
1971	4,667	6,787	7,605	684
1970	4,322	6,226	6,637	619
1969	4,008	5,632	6,008	550
1968	3,655	5,097	5,482	495
1967	3,226	4,546	4,941	461
1966	3,011	4,105	4,509	416
1965	2,779	3,758	4,136	365
1964	2,479	3,331	3,643	310

[a] Additional data are available to 1954. See earlier Annual Survey Reports.

[b] U.S. Sales of finished prescription and "otc ethical" dosage forms.

[c] Global sales are defined to include total ethical pharmaceutical sales within the United States, exports to nonaffiliated firms and sales abroad of U.S. affiliates. Figures apply to PMA member companies only. Historical series has been adjusted accordingly.

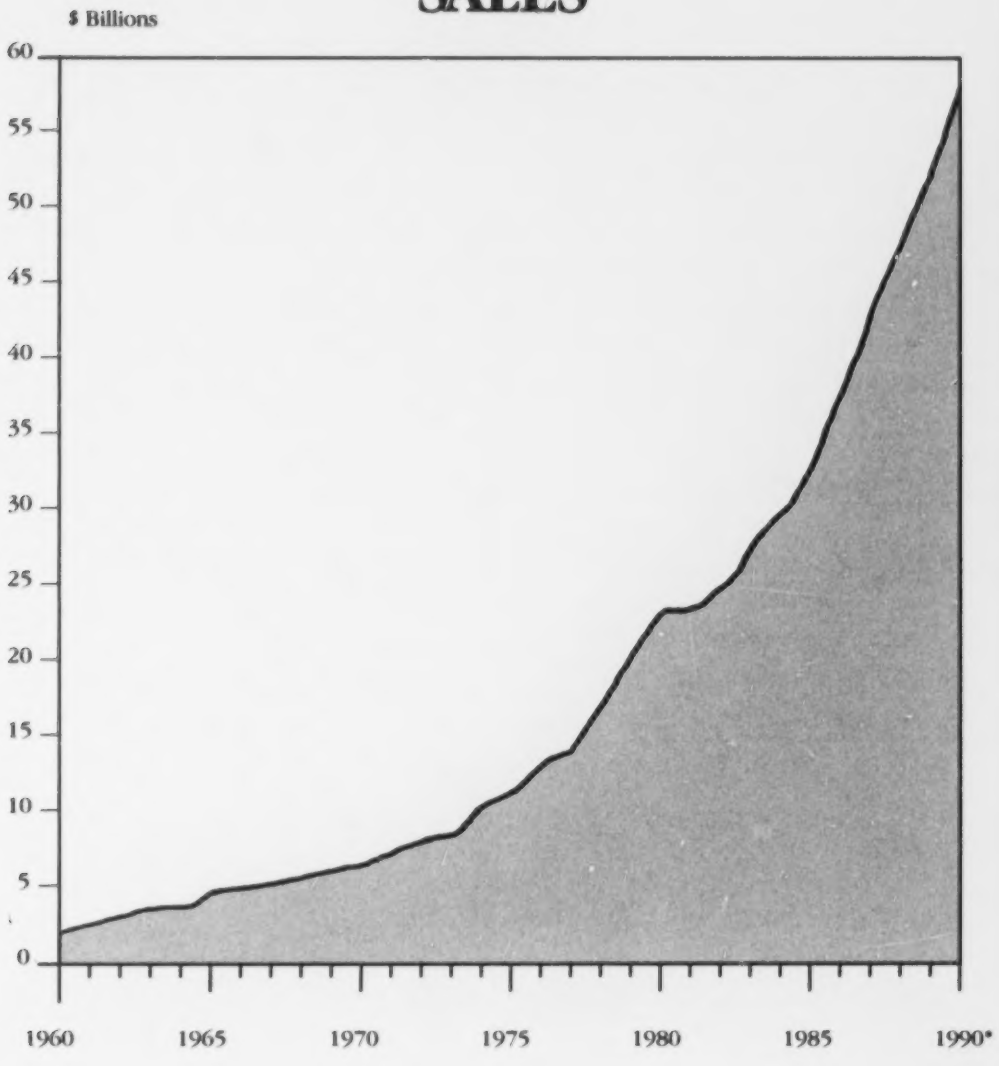
[d] Global R&D includes all ethical pharmaceutical research and development financed or conducted by U.S. pharmaceutical companies in the U.S. and abroad, and in the U.S. only by U.S. based subsidiaries of foreign-owned firms.

[e] PMA estimates based on member company budgeted figures or estimates.

[f] R&D figures for 1979 and 1980 reflect a 21% increase in expenditures; however, part of this increase is due to improved reporting of expenditures in foreign countries. Adjusting for this improved reporting results in an 18% increase.

Source: PMA Annual Survey Report

SALES


$ Billions
60
55
50
45
40
35
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1960
1965
1970
1975
1980
1985
1990*
Projected*

SALES[a]

Highlights

U.S. sales increased 10.4% in 1988 and 10.5% in 1989—sales are predicted to increase 11.6% in 1990. Foreign sales increased by 17.1% in 1988. Sales of prescription legend products represent over 90% of the ethical market in the U.S. European countries receive over 50% of sales abroad; the Pacific and Far East nations represent almost one fourth of sales in 1988. The leading selling product class in the U.S. is cardiovascular products; anti-infectives are the leading sellers abroad. In the U.S. market, more than 70% of manufacturers' sales are distributed through wholesalers.

1987-1990 Sales in the United States and Abroad

- U.S. sales volume rose 10.4% in 1988, an estimated 10.5% in 1989, and was projected to increase by 11.6% in 1990; foreign sales volume increased by 17.1% in 1988, an estimated 6.7% in 1989, and a projected 12.7% in 1990.
- U.S. sales accounted for 62% of volume for U.S. manufacturers in 1988, 63% in 1989 and 63% in 1990.
- Exports amounted to $1,928 million in 1988, down 4.3% from 1987.

Tables 2 and 3.

Ethical Pharmaceuticals Sales Growth, (millions of dollars) **2**

Year	Domestic Sales	Percent Change	Foreign Sales	Percent Change	Total	Percent Change
1987	$26,566.1	+10.2%	$15,068.4	+15.6%	$41,634.5	+12.1%
1988	$29,324.6	+10.4%	$17,649.3	+17.1%	$46,973.9	+12.8%
1989	$32,414.0	+10.5%	$18,838.0	+6.7%	$51,252.0	+9.1%
1990	$36,166.0	+11.6%	$21,240.8	+12.7%	$57,406.8	+12.0%

[a] Sales for PMA member firms only.

1988 Domestic Sales of Dosage Form Products

- Prescription drugs accounted for 91% of U.S. sales in the human use, dosage form category; over-the-counter ethical products accounted for 4% and the remainder came from sales of biologicals, diagnostics and other products.
- Government purchases of ethical pharmaceuticals constituted 6% of the total; 82% of these purchases were prescription drugs.

Domestic Sales of Dosage-Form, Human-Use Ethical Pharmaceuticals, 1988 (millions of dollars) 4

Dosage Form Human Use	To Private Sector	To Government	Total Domestic Sales
Prescription Legend[a]	$26,927.9	$1,423.5	$28,351.4 (90.8%)
Over-the-Counter Ethical[b]	1,300.7	39.5	1,340.2 (4.3%)
Biologicals[c]	732.1	212.6	944.7 (3.0%)
Diagnostic Products[d]	279.4	39.7	319.1 (1.0%)
Other	244.1	25.0	269.1 (.9%)
Total, Dosage Form, Human Use	$29,484.2	$1,740.3	$31,224.5 (100.0%)

[a] Prescription Legend—A drug product which by federal law is available only by prescription from a licensed physician.

[b] Over-the-Counter Ethical—A drug product sold over the counter but primarily promoted to the professions. This does not include proprietary drugs (i.e., OTC products on display for purchase by customers).

[c] Biologicals—Bacterial and virus vaccine, antigens, antitoxins, toxoids, and analogous products (such as allergenic extracts) serums, plasmas, and other blood derivatives for human use.

[d] Dosage form, diagnostic agents for in-vivo use.

1988 Sales by Geographic Area

- Europe accounted for 51% of foreign sales; Japan, Australia and New Zealand 18%; Latin America 11%.

Distribution of Foreign Sales* by Geographic Area, 1987 and 1988

5

Area	Percentage of Total Foreign Sales	
	1987	1988
Canada	10.8%	10.3%
Latin America (Central America, South America, excluding Cuba)	11.2%	10.9%
Western Europe (excluding Turkey, Yugoslavia and Albania; including Greece and Scandinavia)	48.9%	50.9%
Middle East	1.9%	2.0%
Africa	2.8%	3.0%
Far East Pacific (from Pakistan to Pacific Islands)	4.6%	4.4%
Japan, Australia, New Zealand	19.3%	18.0%
Socialist Bloc (Eastern Europe, USSR, Yugoslavia, Albania, Cuba, Peoples' Republic of China, N. Korea, Laos, Cambodia and Vietnam)	.5%	.5%
Total	100.0%	100.0%

*Sales made abroad and exports to third parties.

1987 and 1988 Sales by Class of Customer

- Sales to wholesalers continued to increase.
- Total hospital sales declined from 11.9 to 11.0%.
- From 1978 to 1988 the wholesalers' percentage share of sales increased by nearly 40 percent.

Tables 6 and 7

Manufacturers Sales of Human-Use, Dosage-Form Products, in the United States, 1987, 1988 (millions of dollars)

6

Class of Customer	Sales 1987	Market Share 1987	Sales 1988	Market Share 1987
Wholesalers	$19,463.7	68.8%	$22,231.8	71.2%
Retailers	4,499.3	15.9	4,652.5	14.9
Private Hospitals	2,089.8	7.4	1,904.7	6.1
State and Local Government Hospitals	598.5	2.1	655.7	2.1
Federal Hospitals	685.7	2.4	749.4	2.4
Other Federal Government	374.6	1.3	343.5	1.1
Practitioners	316.6	1.1	374.7	1.2
Manufacturers, Repackagers and Other Direct Sales	259.6	1.0	312.2	1.0
TOTAL	$28,287.8	100.0%	$31,224.5	100.0%

Ethical Pharmaceutical Manufacturers' Direct Human-Use Dosage-Form Sales in the United States by Class of Customer, 1978-1988 (even years, percentage share of sales)

7

Class of Customer	1978	1980	1982	1985*	1986	1988
Wholesalers	51.4%	57.3%	59.6%	67.3%	68.3%	71.2%
Retailers	22.8	20.8	18.0	16.0	15.5	14.9
Private Hospitals	16.0	12.7	13.7	8.8	8.0	6.1
State and Local Government Hospitals	4.2	4.1	3.8	2.5	2.3	2.1
Federal Hospitals	2.4	2.5	2.5	2.1	2.4	2.4
Other Federal Government	1.4	1.2	1.1	1.6	1.5	1.1
Practitioners	1.2	1.0	.8	.7	1.0	1.2
Manufacturers, Repackagers, and Other Direct Sales	.6	.4	.5	1.0	1.0	1.0
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*1984 figures are not available.

1988 Sales by Product Class

- Products acting on the cardiovascular system remained the largest product sales category, accounting for 23% of domestic dosage form sales in 1988.
- Other product classes, in order of U.S. sales rank in 1988, were central nervous system (22%), anti-infectives (15%), neoplasms and endocrine (13%), and gastrointestinal and genitourinary (12%).
- In foreign sales, anti-infectives are first, followed by cardiovasculars and central nervous system. These three groups accounted for over half of the sales abroad.

Tables 8 and 9

Foreign Sales by Product Class, Dosage-Form Ethical Drugs for Human-Use, 1988 (millions of dollars) **9**

Product Class	1988	Percent
Anti-Infectives	$ 3,855.3	24.8%
Central Nervous System	2,394.0	15.4
Respiratory System	653.0	4.2
Gastrointestinal and Genitourinary	1,492.4	9.6
Neoplasms and Endocrine	2,005.4	12.9
Cardiovasculars	2,907.0	18.7
Vitamins and Nutrients	528.5	3.4
Dermatologicals	699.5	4.5
Biologicals	248.7	1.6
Diagnostic Agents	77.7	.5
Other Pharmaceutical Preparations	684.0	4.4
TOTAL	$15,545.5	100.0%

Industry Employment

- PMA member companies employed an estimated 316,240 persons worldwide in pharmaceutical operations in 1988.
- 43% were employed abroad.
- 33% of all U.S. employees were in production, 29% in marketing, and 23% in medical R&D.

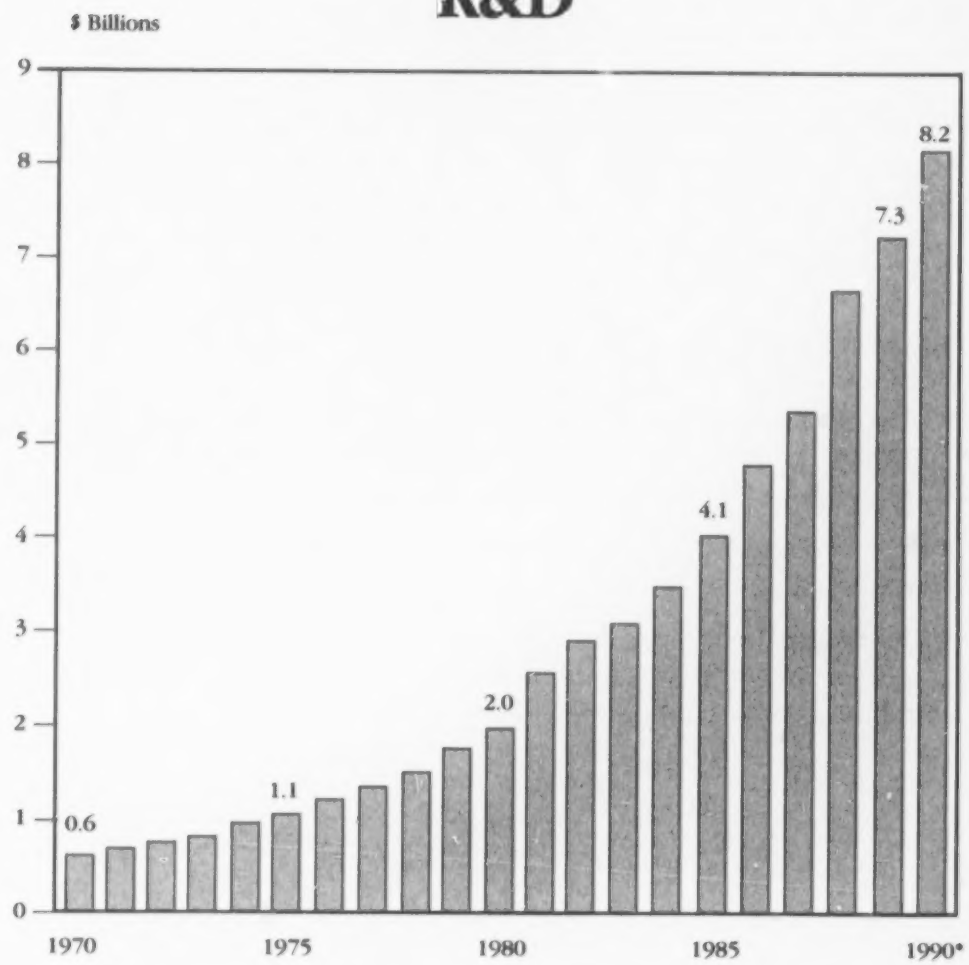
Domestic & Foreign Employment, Ethical Pharmaceuticals, in 1988 — 10

	1988
U.S. Employment	179,420
Production Workers	59,320
Marketing	51,500
Medical Research and Development	41,520
Administrative	19,810
Distribution & Others	7,270
Foreign Employment	136,820
TOTAL	316,240

Employment Abroad by Geographic Area, 1988 — 11

Area	
Canada	7,080
Latin America (Central America, South America, excluding Cuba)	28,060
Western Europe (excluding Turkey, Yugoslavia and Albania; including Greece and Scandinavia)	62,850
Middle East	2,380
Africa	2,980
Far East Pacific (from Pakistan to Pacific Islands)	15,710
Japan, Australia, New Zealand	17,280
Socialist Bloc (Eastern Europe, USSR, Yugoslavia, Albania, Cuba, Peoples' Republic of China, N. Korea, Laos, Cambodia and Vietnam)	480
Total	136,820

R&D



*Projected

R&D

Highlights

PMA members' continuing commitment to R&D is estimated at over $7.3 billion in 1989 and more than 80% of this spending is in the U.S. Manufacturers are devoting the largest percentage of R&D funds, both here and abroad, to research on cardiovascular products. R&D expenditures in the U. S. represent over 16% of total U.S. sales.

1987-1990 Research and Development

- Total R&D expenditures in 1988 reached $6.5 billion, up 18% from 1987. Expenditures for 1989 were budgeted at $7.3 billion and are expected to exceed $8 billion in 1990.
- 97% of company R&D funds were spent on human-use pharmaceuticals, and 3% on animal-use products.
- Government contracts increased from $3.9 million in 1987 to $5.2 million in 1988. $4.2 million was budgeted for 1989 and $7.1 million is projected for 1990.

Table 12

Ethical Pharmaceutical Sales of PMA Member Firms, Domestic and Foreign: Shares of End-Use Totals, 1988 (millions of dollars)

3

	Domestic U.S. Sales			Foreign Sales				Sales for Export Intra-Firm Trans-Actions
	To Private Sector	To Govern-ments	Total Domestic Sales	Exports to Other Firms	Sales Abroad	Total Foreign Sales	Total	
Dosage Form	$26,421.4	$1,577.3	$27,998.7	$520.2	$15,025.3	$15,545.5	$43,544.2	$854.3
Human Use	(60.7%)	(3.6%)	(64.3%)	(1.2%)	(34.5%)	(35.7%)	(100.0%)	
Dosage Form	717.3	3.5	720.8	27.1	786.2	813.3	1,534.1	275.8
Veterinary Use	(46.8%)	(.2%)	(47.0%)	(1.8%)	(51.2%)	(53.0%)	(100.0%)	
Bulk	197.3	.6	197.9	206.2	612.4	818.6	1,016.5	736.2
Human Use	(19.4%)	(.1%)	(19.5%)	(20.3%)	(60.2%)	(80.5%)	(100.0%)	
Bulk	407.2		407.2	14.8	457.1	471.9	879.1	61.6
Veterinary Use	(46.3%)		(46.3%)	(1.7%)	(52.0%)	(53.7%)	(100.0%)	
TOTAL	$27,743.2	$1,581.4	$29,324.6	$768.3	$16,881.0	$17,649.3	$46,973.9 (100.0%)	$ 1,927.9

[a] Sales are before deducting cash discounts and other marketing expenses, but after returns and allowances (domestic returns and allowances totalled $870 million).

[b] Export sales are f.o.b. U.S. port. Domestic sales figures are f.o.b. plant or warehouse. In addition, transportation costs for domestic sales were $165 million and net value of discounts on domestic sales $522 million.

[c] Sales for Export Intra-Firm Transactions are Sales Abroad. Addition of the two export columns will provide aggregate ethical pharmaceutical exports.

Domestic Sales by Product Class, Dosage-Form Ethical Drugs for Human Use, 1988 (millions of dollars)

8

Product Class	Prescription Drugs		Over-the-Counter Ethicals		Total	
	Sales	Market Share	Sales	Market Share	Sales	Market Share
Central Nervous System	$ 6,294.0	22.2%	$ 148.8	11.1%	$ 6,442.8	21.7%
Anti-Infectives	4,479.5	15.8	57.6	4.3	4,537.1	15.3
Gastrointestinal & Genitourinary	3,147.0	11.1	312.3	23.3	3,459.3	11.7
Neoplasms and Endocrine	3,827.5	13.5	57.6	4.3	3,885.1	13.1
Vitamins and Nutrients	708.8	2.5	265.3	19.8	974.1	3.3
Cardiovasculars	6,690.9	23.6	0	0	6,690.9	22.5
Respiratory System	1,927.9	6.8	278.8	20.8	2,206.7	7.4
Dermatologicals	567.0	2.0	209.1	15.6	776.1	2.6
Other	708.8	2.5	10.7	.8	719.5	2.4
TOTAL	$28,351.4	100.0%	$1,340.2	100.0%	$29,691.6	100.0%

1988-1990 Research and Development Expenditures Abroad

- R&D spending abroad by PMA members increased more than 15% in 1988. The share of total R&D spending performed abroad was 18% in 1987 and 19% in 1988. 20.0% was budgeted for 1989.

Tables 13 and 14

1987-1990 Research and Development Distribution of Expenditures

- The share of expenditures devoted to human-use drug research continued to increase slightly. Human-use drug research accounted for 96.6% of total expenditures in 1988 and 1989 (budgeted), and 96.7% in 1990 (projected).
- The share of expenditures for intramural research in the United States for human-use drugs, about two-thirds of the total, showed a slight increase in 1989 of about .6%.

Table 15

Research by Geographic Area, 1987, 1988

- 72% of the research funds spent abroad were spent in Western Europe in 1988. In 1987 the figure was 70%.
- Japan, Australia and New Zealand accounted for 19% of foreign expenditures, Canada for 6% and Latin America for 2%.

Distribution of R&D Expenditures Abroad by Geographic Area, 1987, 1988

16

Area	Percentage of Total 1987	1988
Canada	7.6%	6.3%
Latin America (Central America, South America, Caribbean, excluding Cuba)	2.0	1.5
Western Europe (excluding Turkey, Yugoslavia and Albania; including Greece and Scandinavia)	69.8	72.0
Middle East	.2	.1
Africa	.5	.5
Far East and Pacific (from Pakistan to Pacific Islands)	.4	.3
Japan, Australia and New Zealand	19.4	19.2
Socialist Bloc (including Eastern Europe, U.S.S.R., Yugoslavia, Albania, People's Republic of China, Laos, Cambodia and Vietnam)	.1	.1
TOTAL	100.0%	100.0%

Research and Development Allocation of Expenditures to New Product Research

- 83% of R&D funds are spent for research and development of new products; 17% goes for improvement of existing products.
- Abroad, the ratio of new product/existing product expenditures is 76/24.

Tables 17 and 18

Company-Financed R&D Expenditures in the United States 1988 (percentages) 17

	Human-and Veterinary-Use R&D 1988
Research for the Advancement of Scientific Knowledge and Development of New Products and Related Services	83.0%
Research Oriented to Significant Improvements and/or Modification of Existing Products	17.0%
TOTAL	100.0%

Company-Financed R&D Expenditures in Foreign Countries, 1988 (percentages) 18

	Human-and Veterinary-Use R&D 1988
Research for the Advancement of Scientific Knowledge and Development of New Products and Related Services	76.0%
Research Oriented to Significant Improvement and/or Modification of Existing Products	24.0%
TOTAL	100.0%

1987, 1988 Research and Development Allocation of Expenditures by Product Class

- More than 72% of the research funds went to investigations related to infections, central nervous system, neoplasms, and the heart.
- Cardiovascular product research led with 25% of the total in 1988.
- Research expenditures abroad are most often directed to cardio vascular products. Research on anti-infectives, neoplasms, and central nervous system also receive large shares of total expenditures.

Tables 19 and 20

U.S. R&D Expenditures for Pharmaceuticals, by Product Class, 1987, 1988 (percentages) 19

Product Class	1987	1988
Anti-infectives	13.1%	13.9%
Central Nervous System and Sense Organs	14.5	14.6
Cardiovasculars	27.0	25.1
Neoplasms, Endocrine System and Metabolic Diseases	19.3	18.5
Gastrointestinal and Genitourinary System	5.3	4.1
Respiratory	5.3	5.4
Biologicals	2.8	4.1
Dermatologicals	2.1	2.1
Vitamins	.2	.2
Diagnostic (in vivo)	.7	.7
Other	6.0	7.8
Veterinary Preparations	3.4	3.2
Veterinary Biologicals	.3	.3
TOTAL	100.0%	100.0%

R&D Expenditures Abroad for Pharmaceuticals, by Product Class, 1987, 1988 (percentages)

20

Product Class	1987	1988
Anti-infectives	15.2%	12.9%
Cardiovasculars	28.9	21.1
Central Nervous System and Sense Organs	14.6	13.8
Gastrointestinal and Genitourinary System	8.5	7.9
Neoplasms, Endocrine System and Metabolic Diseases	9.0	15.3
Respiratory	7.0	5.9
Dermatologicals	1.3	2.1
Biologicals	3.1	2.9
Vitamins	.1	.6
Diagnostic (in vivo)	.1	.1
Other	7.7	13.5
Veterinary Preparations	4.5	3.7
Veterinary Biologicals	0.0	0.2
TOTAL	100.0%	100.0%

R&D Expenditures for Ethical Pharmaceuticals: 1987, 1988 (actual), 1989 (budgeted), and 1990 (projected) PMA Member Firms (millions of dollars)

12

	1987 Actual	1988 Actual	1989 Budgeted	1990 Projected
Company-Financed R&D Expenditures for Human Use Pharms.:				
Amount spent in United States	$4,342.2	$5,050.9	$5,710.5	$6,416.9
Within Firm	3,508.4	4,027.1	4,532.9	
Outside Firm	833.8	1,023.8	1,177.6	
Amount spent in foreign countries	$ 968.1	$1,260.9	$1,385.4	$1,543.5
Within Firm	783.1	1,019.3	1,100.6	
Outside Firm	185.0	241.6	284.8	
TOTAL Human-Use R&D	$5,310.3	$6,311.8	$7,095.9	$7,960.4
Company-Financed R&D Expenditures for Veterinary Use Pharms.:				
Amount spent in United States	$ 161.0	$ 177.8	$ 199.8	$ 212.5
Within firm	142.4	161.9	173.5	
Outside firm	18.6	15.9	26.3	
Amount spent in foreign countries	$ 30.0	$ 42.7	$ 46.5	$ 49.3
Within firm	27.8	37.3	39.5	
Outside firm	2.2	5.4	7.0	
TOTAL Veterinary R&D	$ 191.0	$ 220.5	$ 246.3	$ 261.8
TOTAL Company-Financed R&D for Pharmaceuticals	$5,501.3	$6,532.3	$7,342.2	$8,222.2
U.S. Government Grants and Contracts for Company-Conducted Pharmaceutical R&D	3.9	5.2	4.2	7.1
TOTAL Expenditures for Pharmaceutical R&D	$5,505.2	$6,537.5	$7,346.4	$8,229.3

R&D Expenditures for Ethical Pharmaceuticals (millions of dollars) 1988 (actual) 1989 (budgeted), 1990 (projected) 13

	1988		1989		1990	
	Amount	Change 1987–88	Amount	Change 1988–89	Amount	Change 1989–90
Company-Financed, for Human-Use Pharmaceuticals:						
Amount spent in U.S.	$5,050.9	+16.3%	$5,710.5	+13.1%	$6,416.9	+12.4%
Amount spent in foreign countries	1,260.9	+30.2%	1,385.4	+ 9.9%	1,543.5	11.4%
Company-Financed, for Veterinary-Use Pharmaceuticals:						
Amount spent in U.S.	177.8	+10.4%	$ 199.8	12.3%	$ 212.5	+6.4%
Amount spent in foreign countries	42.7	+12.7%	46.6	9.1%	49.3	+5.8%

Domestic and Foreign Shares of Company-Funded R&D Expenditures 1983–89 (percentages) 14

	1983	1984	1985	1986	1987	1988	1989*
R&D Expenditures, Human-and-Animal-Use Pharmaceuticals							
Domestic	83.0	83.0	83.0	82.0	82.0	81.0	80.0
Foreign	17.0	17.0	17.0	18.0	18.0	19.0	20.0
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*1989 figures are budgeted or estimated.

R&D Expenditures for Ethical Pharmaceuticals, Allocation of Funds (percentages) 1987, 1988 (actual), 1989 (budgeted) and 1990 (projected)

15

Category of R&D Expenditures for Ethical Pharmaceuticals	1987	1988	1989 (Budgeted)	1990 (Projected)
Company-Financed R&D Expenditures for Human-Use Products:				
Percentage spent in the United States	78.87%	77.26%	77.73%	77.97%
Within firm	63.73	61.60	61.70	
Outside firm	15.14	15.66	16.03	
Percentage spent in foreign countries	17.59%	19.29%	18.86%	18.76%
Within firm	14.23	15.59	14.98	
Outside firm	3.36	3.70	3.88	
TOTAL Human-use R&D	96.46%	96.55%	96.59%	96.73%
Company-Financed R&D Expenditures for Veterinary-Use Products:				
Percentage spent in the United States	2.92%	2.72%	2.72%	2.58%
Within firm	2.59	2.48	2.36	
Outside firm	.33	.24	.36	
Percentage spent in foreign countries	.55%	.65%	.63%	.60%
Within firm	.51	.57	.54	
Outside firm	.04	.08	.09	
TOTAL Veterinary R&D	3.47%	3.37%	3.35%	3.18%
TOTAL Company-Financed R&D	99.93	99.92	99.94	99.91
U.S. Government Grants and Contracts for Company-Conducted R&D	.07	.08	.06	.09
TOTAL Expenditures for R&D	100.00%	100.00%	100.00%	100.00%

Research and Development Allocation of Expenditures by Function

- About half of all R&D expenditures is allocated to Biological Screening and Pharmacological Testing, Clinical Evaluation, and Synthesis and Extraction.
- The largest share, 26%, is spent on Clinical Evaluation: Phases I, II, and III.

Distribution of U.S. R&D Expenditures for Ethical Pharmaceuticals by Function

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Function	Percentage of Total 1987	1988
Clinical Evaluation: Phases I, II, III	24.0%	26.4%
Biological Screening and Pharmacological Testing	16.8	16.7
Synthesis and Extraction	10.3	10.3
Pharmaceutical Dosage Formulation and Stability Testing	9.1	9.1
Toxicology and Safety Testing	8.3	7.8
Process Development for Manufacturing and Quality Control	9.4	9.1
Clinical Evaluation: Phase IV	4.4	3.5
Regulatory, IND and NDA Preparation, Submission and Processing	3.6	3.0
Bioavailability Studies	3.0	2.8
Other	11.1	11.3
TOTAL	100.0%	100.0%

1986-1988 Research and Development Employment

- R&D employment in PMA member firms totalled 51,400 in 1988, 81% of this total in the U.S. This total represents a 2% increase over 1987.
- The average R&D expenditure per R&D employee in the U.S. was $97,574 in 1988, 5% higher than the figure for 1987.
- Firms investing over $100 million in R&D employed about two thirds of the total R&D personnel in the U.S.

Tables 22, 23, 24 and 25

R&D Personnel in the United States, by Position Level

22

Category	1986	1987	1988
Scientific and Professional	24,500	26,890	27,230
Technical	6,250	6,260	6,320
Supporting Staff	7,520	7,760	7,970
Total	38,270	40,910	41,520

R&D Personnel in U.S. and Abroad, 1984-1988

23

Year	Grand Total	U.S.	Abroad
1984	42,600 (100%)	34,100 (80%)	8,500 (20%)
1985	44,700 (100%)	35,800 (80%)	8,900 (20%)
1986	47,770 (100%)	38,270 (80%)	9,500 (20%)
1987	50,610 (100%)	40,910 (81%)	9,700 (19%)
1988	51,400 (100%)	41,520 (81%)	9,880 (19%)

Research and Development/Sales Ratio

- The percentage of the domestic pharmaceutical sales dollar allocated to domestic R&D was 16.3% in 1988. For 1989 the estimated percentage is 16.7% and the projected ratio for 1990 is 16.8%.

R&D as a Percentage of Sales, Ethical Pharmaceuticals 26

Year	1984	1985	1986	1987	1988	1989*	1990**	Average 1984–1990
Ratio	14.4	14.8	14.8	15.8	16.3	16.7	16.8	15.7

Human and veterinary ethical pharmaceuticals. R&D is domestic U.S. only as financed by companies for internal and external performance. Sales basis: Domestic sales plus exports to other firms and intrafirm exports but excluding sales of foreign plants owned by U.S. firms. Data represent all PMA member firms.

*Estimated or Budgeted

**Projected

Glossary

Definitions used in the 1988–1990 Survey

Biologicals—Bacterial and virus vaccine, antigens, antitoxins, toxoids, and analogous products (such as allergenic extracts), serums, plasmas, and other blood derivatives for human use.

Bulk—For use as a pharmaceutical or medicinal product in further manufacture or in packaging by another company, or for processing in animal feeds (but not as nutritional ingredients), or in prescription compounding, etc.

Company or Firm—Manufacturers including parent, affiliated and subsidiary companies, without duplication engaged in production of ethical pharmaceuticals, biologicals, and diagnostic products.

Diagnostic Agents (in vivo)—Diagnostic products used in living body.

Employment—All full-time production workers as well as officers of the company, including employees engaged in the following activities: factory supervision above the working foreman level, sales, advertising, financial, clerical, executive, purchasing, legal, personnel, professional and technical.

1. *Production Workers*—Employees up through the working foreman level engaged in fabricating, processing, assembling, receiving, inspection, quality control, handling, packing, warehousing and storage, shipping, maintenance, repair, janitorial, watchman service, production development, record keeping, and other services associated with the production operations.
2. *Medical Research and Development*—Personnel engaged in research, research administration, clinical evaluation and development; excludes personnel in promotion, sales, market research, business administration, production and quality control.
3. *Sales and Marketing Research Employees*—Personnel in sales, advertising, sales promotion, market research, etc.
4. *Administrative Employees*—Personnel responsible for general management, accounting, finance, planning, personnel, purchasing office services, legal secretarial, etc.
5. *Distribution*—Personnel responsible for distribution, including transportation and warehousing.

Employment Abroad—Total number of full-time employees, whether U.S. citizens or not, of PMA member firms or any wholly owned overseas corporation, or corporations in which PMA member firms had a substantial or controlling interest.

Ethical Pharmaceuticals—Products, including biological and medicinal chemicals, used for the cure, alleviation, mitigation, treatment, prevention or diagnosis of disease in humans or animals and promoted primarily to the medical, pharmacy and allied professions; includes products for over-the-counter ethical sales as well as for ultimate dispensing by prescription only.

Exports—"f.o.b.," U.S. port.

a) To other firms: sales to third parties only.

b) Intrafirm transactions: sales and shipments at billed (and end sales) value to subsidiaries and affiliates for further handling, processing or packaging.

Governmental Grants and Contracts for Company-Conducted R&D—Grants and contractual payments received by companies from governmental agencies for pharmaceutical research and development.

Over-The-Counter Ethical—A drug product sold over the counter but primarily promoted to the professions. This does not include proprietary drugs (i.e., OTC products on display for purchase by consumers).

Prescription Legend—A drug product which by Federal law is available only by prescription from a licensed physician.

Research and Development—The term includes basic and applied research as well as development activities carried on or supported in the pharmaceutical, biological, chemical, medical and related sciences, including psychology and psychiatry, if the purpose of such activities is concerned ultimately with the utilization of scientific principles in understanding diseases or in improving health.

R&D Expenditures—The total cost incurred for all pharmaceutical research and development activity, including cost of salaries, other direct costs, service, routine supplies, and supporting costs, plus a fair share of overhead (administration, depreciation, space charges, rent, etc.).

Costs of drugs or medical research and development conducted on grant or contract for other companies are excluded. Conversely, total outlays for all research and development work contracted to others (manufacturers, independent research laboratories, academic institutions, etc.) are included.

Research and Development Expenditures Within Firm—Includes research and development expenditures in the United States and foreign countries in the firm's own research laboratories.

Research and Development Expenditures Outside Firm—Research and development funds contracted or granted to such organizations as commercial laboratories, private practitioners, consultants, etc., educational institutions, non-profit research institutions, manufacturing and other companies or other research performing organizations.

R&D Manpower—Personnel engaged in research, research administration, clinical evaluation and development: excludes personnel in promotion, sales, market research, business administration, production and qualilty control.

Research and Development Scientific and Professional Staff—Includes all persons whose work requires the application for research and development of knowledge, skills and scientific techniques, in the life, physical, engineering, or mathematical sciences, acquired through the completion of a four-year college course (or its equivalent) with a major in these fields or in medicine or other health professions. Excludes persons who have formal training in the sciences but who are not actively engaged in research and development.

Research and Development Support Staff—Includes persons who provide literature, clinical, statistical, or other services specifically for R&D staff and technicians.

Research and Development Technicians—Includes persons actually engaged in technical work at a level which requires knowledge of the life, physical engineering, or mathematical sciences comparable at least to that acquired through technical institutes, junior colleges, or other formal post-high school training less extensive that four-year college training, or through equivalent on-the-job training or experience. However, also included are persons who hold an academic degree at the bachelor's level or above.

Sales—Sales figures are reported as billed (before deducting cash discounts on sales and other marketing expense), less returns and allowances. Includes sales value of products bought and resold without further processing or repacking as well as the dollar value of products made from own materials for other manufacturers' resale. Excluded are all royalty payments, interest and other income.

Sales Abroad—Actual sales consummated in foreign countries other than "Sales for Exports or Other Firms." Such sales by affiliates and subsidiaries or other operations abroad are reported in dollars, computed at December 31 rate of exchange (when possible) for the year shown. Where a partially owned subsidiary is involved, the firm's share is determined on a proportionate profit-sharing basis.

Sales for Export—Reported as "f.o.b. U.S. port."

1. *To Other Firms*—Excludes intracompany transactions, includes sales to third parties only.
2. *Intracompany Transactions*—Includes sales and shipments to subsidiaries or affiliates for further handling, processing, or finishing by them. Reported as net billed value, not end sales values.

Sales by Product Class—Estimated distribution of domestic sales of ethical pharmaceutical and biological dosage-form preparations in accordance with the classification system used in the annual Current Industrial Reports from the Bureau of the Census.

Sales to Governments—Sales or shipments made directly to federal, state or local government agencies, hospitals and clinics.

Sales to Private Sector—Sales through regular marketing channels for end-use other than by government agency administration or distribution.

U.S. Intramural R&D Expenditures for Human and Veterinary Use Pharmaceuticals per R&D Employee, 1988

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Annual R&D Expenditure	Average Expenditure Per R&D Employee 1988
Over $100 million	$159,564
$30-$100 million	69,328
Under $30 million	12,164
Average, All Firms	97,574

R&D Employment by Company R&D Expenditures, 1988

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Annual R&D Expenditures	Total	Scientific & Professional	Technicians	Supporting	Scientists per 100 Employees
Over $100 million	27,680	18,380	4,040	5,250	65
$30–100 million	7,450	4,990	860	1,600	57
Under $30 million	6,390	3,860	1,420	1,120	58
Total:	41,520	27,230	6,320	7,970	63